Validation of a Rapid Mental Health Screening Tool for Use Following Traumatic Events

Nikki N. Jordan, MPH[1]; Jennifer Auchterlonie, MS[1]; Charles Hoge, MD[2]; Sam Jang, DO MPH[1]

[1]U.S. Army Center for Health Promotion & Preventive Medicine

[2]Walter Reed Army Institute of Research

ABSTRACT

Background: The Pentagon Post Disaster Health Assessment (PPDHA), administered to Pentagon personnel within 4 months of the 9/11 attack, employed a newly developed mental health screening tool designed for rapid detection of individuals at increased risk for PTSD, depression, generalized anxiety, panic attacks, and alcohol abuse. The screening tool has since demonstrated substantial construct validity in terms of self-reported functional impairment.

Objective: To assess the survey's predictive validity based upon future psychological outcomes.

Methods: Military health system medical records for the PPDHA's active duty respondents 1 year prior to the attack and within 18 months afterward were linked with survey data. Logistic regression was used to evaluate the screening tool's ability to predict diagnosed mental disorders.

Results: Among 1812 active duty survey respondents, approximately 29% met the PPDHA screening criteria for high risk for the mental health outcomes examined. There was a statistically significant association between the screening algorithms used and diagnosed mental disorders post 9/11 (Adjusted OR=2.2, 95%CI: 1.5-3.3). Additional factors predictive of post 9/11 mental disorders included female gender, younger age, Army affiliation, enlisted status, history of mental health treatment, 9/11 injury, and witnessing a 9/11 death/injury.

Conclusion: Rapid and effective evaluation of mental health outcomes due to traumatic events is essential for expediting appropriate care. Results from this study further validate the PPDHA's mental health screening tool for use in that regard.

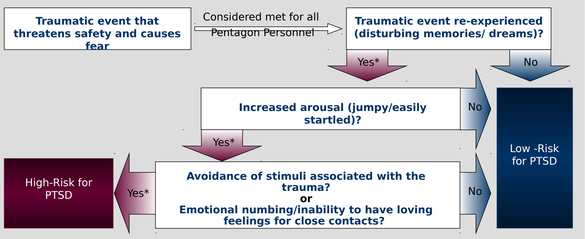
Recommendation: The PPDHA mental health screening tool could serve as a template for future rapid needs assessments however, further validation studies that incorporate sensitivity/specificity testing are warranted.

BACKGROUND

- In the wake of the 9/11 attack on the Pentagon, the Pentagon Post Disaster Health Assessment (PPDHA) was developed as a means of documenting exposures, injuries, and illness sustained and to facilitate receipt of timely and appropriate care. Fundamental to this assessment was the evaluation of mental health needs.[1-2]
  - The survey was administered to Pentagon personnel from 15 Oct 2001 to 15 Jan 2002.
  - Mental health outcomes deemed most important following such a terrorist attack included post traumatic stress disorder (PTSD), depression, generalized anxiety, panic attacks, and alcohol abuse. A condensed 17-item screening tool was developed to both evaluate and validate these symptom domains.[3] **Figures 1-5**
  - Among the 4,739 survey respondents, mental health symptoms were the most prevalent finding. Approximately 40% screened positive for high-risk of any of the mental health outcomes examined.
  - There was a significant association between these formulated high-risk mental health groups and reported functional impairment, use of counseling services, and anticipated risk factors, which demonstrated that the screening tool had substantial construct validity.[4]
- To further validate the survey's mental health screening tool, pre and post 9/11 medical records for the active duty participants were reviewed. Using this approach, the survey's ability to predict mental disorders could be evaluated while adjusting for pre-existing conditions.

PPDHA Mental Health Outcome Algorithms

Figure 1. PTSD High-Risk Group



*Responses on Likert scale - moderate to extreme levels considered positive

Figure 2. Depression High-Risk Group

Figure 3. Generalized Anxiety High-Risk Group

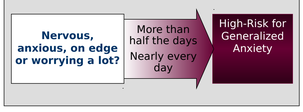


Figure 4. Alcohol Abuse High-Risk Group

Figure 5. Panic Attacks High-Risk Group

METHODS

- De-identified inpatient and outpatient medical data were obtained for PPDHA active duty survey participants through USACHPPM's Army Medical Surveillance Activity (AMSA) as per protocol requirements approved by the Walter Reed Army Institute of Research Internal Review Board.
- AMSA demographic data for the active duty stationed at the Pentagon on 9/11/2001 was also furnished to enable determination of the representativeness of the sample.
- Trends in healthcare utilization for mental disorders (ICD9 CM codes 290-319, excluding 305.1, tobacco dependency) were examined for the time period 01 September 2000 – 28 February 2003. Diagnostic categories evaluated are listed in **TABLE 1**.
- Descriptive analysis of the survey population, PPDHA mental health outcomes, and diagnosed mental disorders was performed.
- Validation of PPDHA high-risk group algorithms was based on determination of a significant association with mental health diagnoses reported during post 9/11 inpatient and/or outpatient visits.
- Logistic regression was performed to determine significantly predictive risk factors for post 9/11 mental health diagnoses. The screening tool, available demographics and factors shown to be predictive in the trauma literature to include pre-existing mental health conditions were incorporated in the model.

Table 1. ICD9 Diagnostic Categories of Mental Disorders Evaluated*

Diagnostic Mental Disorder Category	ICD9-CM Codes
Substance Abuse (excludes tobacco dependency)**	**291, 303, 305.0, 292 (excluding 292.2), 304, 305.2-305.7, & 305.9**
Adjustment Reaction	**309.0, 309.24, 309.28, 309.3, 309.4, 309.9**
Mood Disorder (includes depressive disorders)**	**296.0, 296.2-296.7, 296.80, 296.89, 296.90, 300.4, 301.13, 311**
Anxiety (includes PTSD, acute reactions to stress, and panic attacks)**	**300.00-300.02, 300.21-300.29, 300.3, 308.3, 309.81**
Somatoform	**300.11-300.19, 300.6, 300.7, 300.81, 307.80, 307.89**
Other	**All 290-319 not listed above, excluding 305.1 (tobacco dependency)**
Total	**Any of the above**

*Data source: AMSA inpatient and outpatient medical records (01 Sep 2000 – 28 Feb 2003)
**Categories used as surrogates for the validation of PPDHA mental health risk group algorithms detailed in Table 4

RESULTS

- Medical data were available for 1,812 (95.3%) of the 1,902 PPDHA active duty respondents.
- The majority of respondents were male (78%), officers (66%), and affiliated with the Air Force or Army (77%), with a mean age of 39 yrs $\pm$ 7 years. Demographics for the active duty survey population were comparable to those of active duty members stationed at the Pentagon on 9/11. **Table 2**
- Approximately 29% of the cohort screened positive for any of the PPDHA high-risk mental health outcomes: Generalized anxiety (17.6%), Panic attacks (13.9%), Depression (10.9%), PTSD (4.5%), and Alcohol Abuse (1.9%). **Table 3**
- The PPDHA screening tool's high-risk group algorithms were significantly associated with diagnosed mental disorders post 9/11. Overall, survey respondents who screened positive for high-risk were 3.4 times more likely to be diagnosed with a mental disorder than those who screened negative (Crude OR=3.4, 95%CI: 2.4-4.8). **Table 4**
- The screening tool remained a significant predictor of risk after adjustment for other potential risk factors (Adjusted OR=2.2, 95%CI: 1.5-3.3). Additional factors shown to be associated with a diagnosed mental disorder post 9/11 included: female gender, younger age, Army affiliation, enlisted status, 9/11 injury, witnessing 9/11 death/injury, and history of prior mental health treatment. **Table 5**

Table 2. Demographic Comparison (Survey active duty (AD) population vs Pentagon AD population)

Demographics		Survey AD Population* N=1,812	Pentagon AD Population* N=9,029
Gender:	Female	393 (21.7)	1,660 (18.4)
	Male	1,419 (78.3)	7,363 (81.5)
	Unknown	0	6 (0.1)
Age:	<30	344 (15.5)	902 (10.0)
	30-39	775 (42.7)	3,726 (41.6)
	≥40	793 (43.8)	4,288 (47.5)
Mean (±Standard Deviation)		38.6 (± 7.1)	39.4 (± 7.1)
Race:	Black	311 (17.2)	1,961 (21.7)
	White	1,380 (76.2)	6,527 (72.3)
	Other	115 (6.4)	490 (5.4)
	Unknown	6 (0.3)	51 (0.6)
Marital Status:	Married	1,424 (78.6)	7,187 (79.6)
	Single	293 (16.2)	1,327 (14.7)
	Other	95 (5.2)	508 (5.6)
	Unknown	0	7 (0.1)
Service:	Army	652 (36)	3,261 (36.1)
	Air Force	736 (40.6)	4,092 (45.3)
	Navy/Marines	424 (23.4)	1,676 (18.6)
Grade:	Enlisted	608 (33.6)	2,771 (30.7)
	Officer	1,204 (66.4)	6,258 (69.3)
Occupation:	Combat	506 (27.9)	2,521 (27.9)
	Healthcare	149 (8.2)	487 (5.4)
	Other	1,157 (63.9)	6,021 (66.7)
Education:	High School or Less	410 (22.6)	1,866 (20.7)
	Some College	117 (6.5)	506 (5.6)
	Bachelors	287 (15.9)	1,423 (15.8)
	Masters	894 (49.3)	4,713 (52.2)
	Doctorate	95 (5.2)	432 (4.8)
	Unknown	9 (0.3)	57 (0.6)
Persian Gulf War Veteran:	No	1,530 (84.4)	7,600 (84.2)
	Yes	282 (15.6)	1,429 (15.8)
Other War Veteran:	No	1,496 (82.6)	7,502 (83.1)
	Yes	316 (17.4)	1,527 (16.9)

* AD service members who completed a survey related to 11-SEP-2001; * AD service members stationed at the Pentagon (zip codes 20330, 20310, 20350, 20301, 20318) 11-SEP-2001

Table 3. PPDHA Mental Health High-Risk Groups

High-Risk Group	Frequency (%) N=1812*
Generalized Anxiety	**314 (17.6%)**
Panic Attacks	**248 (13.9%)**
Depression	**195 (10.9%)**
PTSD	**81 (4.5%)**
Alcohol Abuse	**34 (1.9%)**
Any Mental Health High-Risk Group	**509 (28.6%)**

*Denominators used to calculate percentages differ slightly from the total N due to missing data

Table 4. Diagnosed Mental Disorders by PPDHA High-Risk Groups

Diagnostic Category (PPDHA High-Risk Group(s))		PPDHA High-Risk Group Screen (+)	PPDHA High-Risk Group Screen (-)	Crude OR (95% CI)
Anxiety (PPDHA: Generalized Anxiety, Panic, and/or PTSD)				
	Yes	**26 (5.8%)**	**10 (0.7%)**	
	No	**423 (94.2%)**	**1343 (99.3%)**	**8.3 (3.9-17.3)**
Mood Disorder (PPDHA: Depression)				
	Yes	**18 (9.2%)**	**23 (1.4%)**	
	No	**177 (91.8%)**	**1566 (98.6%)**	**6.9 (3.7-13.1)**
Substance Abuse (PPDHA: Alcohol abuse)*				
	Yes	**1 (2.9%)**	**8 (0.5%)**	
	No	**33 (97.1%)**	**1746 (95.5%)**	**6.6 (0.8-54.4)**
Any Diagnosed Mental Disorder (PPDHA: Any High-Risk Group)**				
	Yes	**72 (14.3%)**	**59 (4.7%)**	
	No	**437 (85.9%)**	**1209 (95.3%)**	**3.4 (2.4-4.8)**

*Alcohol abuse diagnosed for the survey respondents was alcohol related.
**Adjustment disorder, somatoform and other mental disorders less frequent within this diagnostic category, along with those listed above.

Table 5. Risk Factor Analysis*

Predictors of Risk	Diagnosed Post 9/11 Mental Disorder OR (95% CI)
Gender (Female : Male)	**2.65 (1.76-3.97)**
Service: Army	**1.00**
Air Force	**0.64 (0.42-1.00)**
Navy/Marines	**0.54 (0.32-0.92)**
Officer Status (Officer: Enlisted)	**0.39 (0.18-0.88)**
Mental Health History (Y : N)**	**4.09 (2.64-6.35)**
Injured from attack (Y : N)	**2.38 (1.17-4.83)**
Witnessed Death/Injury (Y : N)	**2.01 (1.23-3.28)**
PPDHA Screen positive (Y : N)	**2.19 (1.48-3.25)**

*Significant findings listed ($p \leq 0.05$). Results are adjusted for all other terms included in the logistic regression model: gender, age, race, education, marital status, officer status, military service, veteran status, mental health history, injury from 9/11 attack, trapped during 9/11 attack, witnessed death/serious injury from attack, knew dead/seriously injured from attack, location on 9/11, (at Pentagon vs. not), 2 or more close confidants, PPDHA mental health screen positive.
**Prior history determined by positive PPDHA survey response or review of medical records one year prior to the 9/11 attack

LIMITATIONS

- Lack of a universal gold standard (e.g. clinician diagnostic interviews or follow-up inquiries using full scale screening measures for mental disorders) for comparison with the PPDHA screening tool results, prevented accurate determination of sensitivity, specificity, and positive predictive value estimates for the screening tool.
- It was also not possible to determine the full extent to which a survey respondent sought mental health care outside the military healthcare system or through military campaigns to provide anonymous mental health care post 9/11 (eg. Operation Solace); therefore the diagnosed mental disorders reported are likely an underestimate. PPDHA survey data confirms that a substantial number of respondents sought care through outside sources.
- Other potential stressors or risk factors such as deployment history were not readily available for inclusion in the regression model.

CONCLUSION

Valid mental health screening tools for use in rapid needs assessments following traumatic events can aid in determining and prioritizing who is in need of preventive and/or therapeutic measures to ensure a healthy and fit force. The condensed mental health screening tool incorporated into the PPDHA is an example of such an instrument. The survey effectively predicted subsequent mental disorders among a representative sample of active duty soldiers stationed at the Pentagon at the time of the 9/11 attack.

While the PPDHA mental health screening tool continues to show promise as a template for future rapid needs assessments, further efforts to validate and refine the instrument are warranted.

Acknowledgements

- COL(ret) Walter Egerton, COL George Dydek, LTC(ret) James Wells, and MAJ Steve Tobler for initial guidance and support with the PPDHA survey
- LTC Charles Engel, COL David Orman, COL Edward Crandell, COL Virgil Patterson, MAJ Anthony Cox, and Dr. Robert Ursano for assistance with development of the PPDHA mental health screening tool
- Ms. Abigail Wilson for requisition of AMSA data
- Ms. Michelle Chervak for review of poster

References

- 1. Egerton WE, Dydek GJ, Jordan NN, et al. Pentagon Post Disaster Health Assessment Survey. Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine, 2001, 13-HG-7685-02.
- 2. Wells JD, Egerton WE, Cummings LA, et al. The U.S. Army Center for Health Promotion and Preventive Medicine response to the Pentagon attack: a multipronged prevention-based approach. Mil Med. 2002 Sep; 167(9 Suppl):64-7.
- 3. Hoge CW, Engel CC, Orman DT, et al.: Development of a brief questionnaire to measure mental health outcomes among Pentagon employees following the September 11, 2001 attack. Mil Med. 2002 Sep;167(9 Suppl):60-3.
- 4. Jordan NN, Hoge CW, Tobler SK, Wells JD, Dydek GJ, Egerton WE. Mental health impact of 9/11 Pentagon attack: validation of a rapid assessment tool. Am J Prev Med. 2004 May;26(4):284-93.